INSTRUCTION MANUAL

SENSOPTIC FIBER-OPTIC DISPLACEMENT TRANSDUCER

Model FOD

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1 PRODUCT

1.1 GENERAL

The fiber-optic displacement transducer is used to measure movements such as:

- The opening or closing of construction joints in buildings, bridges and pipelines
- The amount of opening or contraction of joints in concrete structures
- Joint and crack openings within rock and concrete masses or at rock-concrete interfaces.

The FOD is supplied with either an embedment type or surface-mounted installation fixture.

All Roctest fiber optic readout equipments can read the FOD. Data acquisition systems are also available. Contact manufacturer for more details.

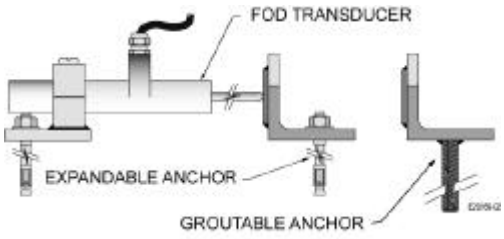
The FOD is delivered with a calibration data sheet providing calibration factors to be used in the displacement equation. The displacement equation converts readings units into engineering units. The calibration factors are determined by factory calibration.

1.2 DESCRIPTION

Our unique design is based on a Thin Film Fizeau Interferometer device (TFFI) mounted on a movable shaft. The TFFI can be seen as a spatially distributed Fabry-Perot cavity where the cavity length varies along the lateral position. The optical fiber is mounted in a manner that the tip is facing the surface of the TFFI, which is moved relative to the optical fiber extremity. By connecting this device to one of Roctest's white-light fiber-optic readout unit, it becomes an absolute position and displacement transducer.

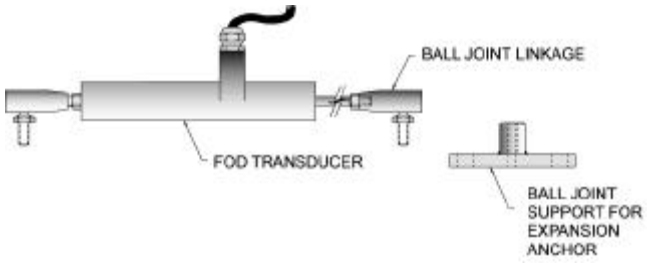
The FOD is totally immune to electromagnetic and radiofrequency (EMI/RFI) interferences and carries no risk of current leakage or ignition. The FOD can be packed in a very compact form and can be located far away (up to 2 km) from the readout unit. These characteristics make the FOD well suited for difficult-to-reach locations and hazardous environments such as those containing explosive materials.

The surface-mounted FOD is available in two models: **FOD-F** and **FOD-J**. The **FOD-F** is mounted on an anchor block. Its loaded-spring spindle remains continuously in contact with an anchored reference surface.



Model FOD-F

With the **FOD-J** confiuration, both extremities are fixed to ball joint linkages that mate with the anchors. This model is fited with a telescopic plunger free to move in or out of the housing as the distance between the measurement points varies. The **FOD-J** allows for small latteral displacements.



Model FOD-J

Both configurations are available with groutable or expansion anchors.

1.3 CALIBRATION

All displacement transducers are individually calibrated before shipment.

A calibration sheet, supplied with each gage, included the following informations:

- The serial number
- The temperature during the calibration
- The calibration factors: A, B, C, D.
- The conversion equation
- The fiber optic cable type and its length

1.4 SPECIFICATIONS

Linear Stroke:	20 mm
Accuracy:	±0.1% of F.S.
Resolution:	0.002 mm
EMI/RMI susceptibility:	Intrinsic immunity
Cable length:	1.5 meter length. Custom length up to 2 km and high temperature cable available
Cable material:	4.0 mm O.D. polyurethane jacket (other material available)
Housing material:	Aluminum or stainless steel
Connector:	ST
Dimensions:	144 mm length x 19 mm O.D. (other size optionally available)

2 READING PROCEDURE

2.1 INITIAL READINGS

Gage readings should be taken as soon as the gages are received to ensure that they have not been damaged during shipment. Please review the readout unit instruction manual before proceeding with the reading.

Before a transducer can be used with the fiber-optic readout unit from Roctest, its gage factor (0001000) must be first selected. The gage factor, already recorded in the memory of the readout unit, is registered on a label installed on the cable close to the fiber-optic connector and on the calibration sheet of the gage.

After that, readings displayed be the readout can be read and used it in the equation supplied on the calibration data sheet to obtain the displacement in engineering units.

Steps before taking a reading

1. Select gage factor (0001000) in the readout memory
2. Associate gages to appropriate channel number and gage factor
3. Be sure that you have the displacement equation and the calibration factors appropriate to each gage.

2.2 DISPLACEMENT EQUATION

The reading value on the readout unit must be converted in engineering unit such as millimeter (mm) or inch (in) by the displacement equation supplied on the calibration data sheet. The equation is:

$$\mathbf{Disp = A (L_1-L_0)^4 + B(L_1-L_0)^3 + C(L_1-L_0)^2 + D(L_1-L_0)} \quad (1)$$

where: Disp = Displacement
A,B,C,D= Calibration factors given on the calibration data sheet
L_0 = Initial reading given on the calibration data sheet
L_1 = Current reading in unit

Note:
The initial reading (L_0) correspond to the gage central position (0 mm) which is located nearest to the middle of FOD range.

2.3 INTERPRETATION

The reading seen on the readout unit is the distance between the actual point and the reference point (located at mid-range) established during factory calibration.

Therefore, it is necessary to fix your own reference point by taking an initial reading after installation is completed. The initial displacement (D_0), calculated with equation 1, gives your reference displacement. Then you can compare the following reading (D_1) to the reference and compute the real displacement (D_{real}).

The following equation indicates how to calculat real displacement.

$$D_{real} = D_1 - D_0 \quad (2)$$

Note:
A positive value of D_{real} indicates an increasing displacement (extension of shaft) and a negative value indicates a decreasing displacement or contraction.

3 INSTALLATION

Prior installation of the fiber optic displacement transducer, a starting point must be determined. This position must be:

- Mid-range : to measure extension or contraction
- End of range (shaft in complete extension): to measure mostly contraction
- Beginning of range: to measure mostly extension

4 CABLE

The gage factor and the serial number corresponding to each FOD are stamped on a tag fastened to the readout end of the cable. In option, the serial number is stamped along the entire length of the cable. Should the cable be cut, we recommend the use of our cable splice kits. Call the manufacturer for details.